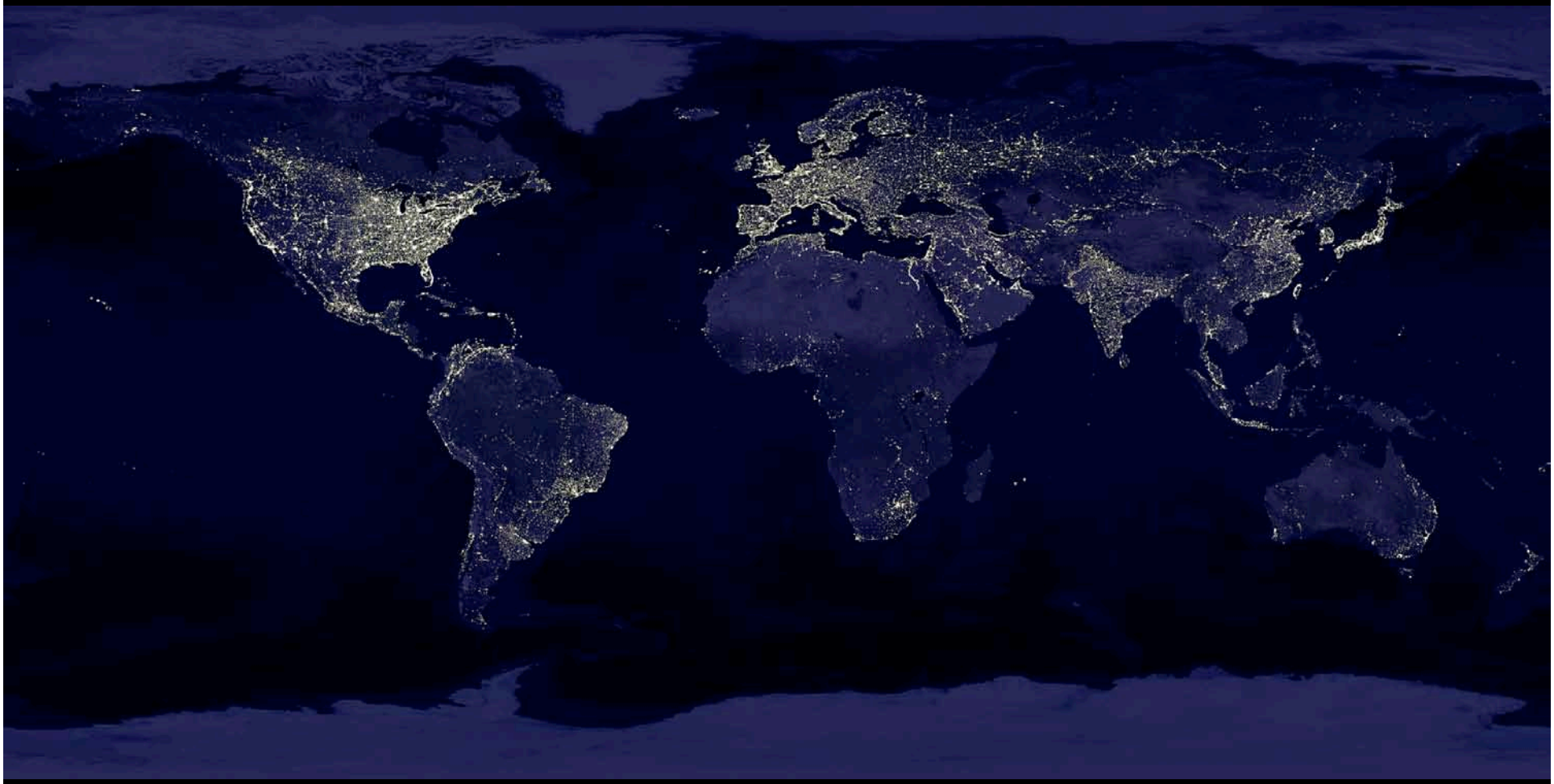
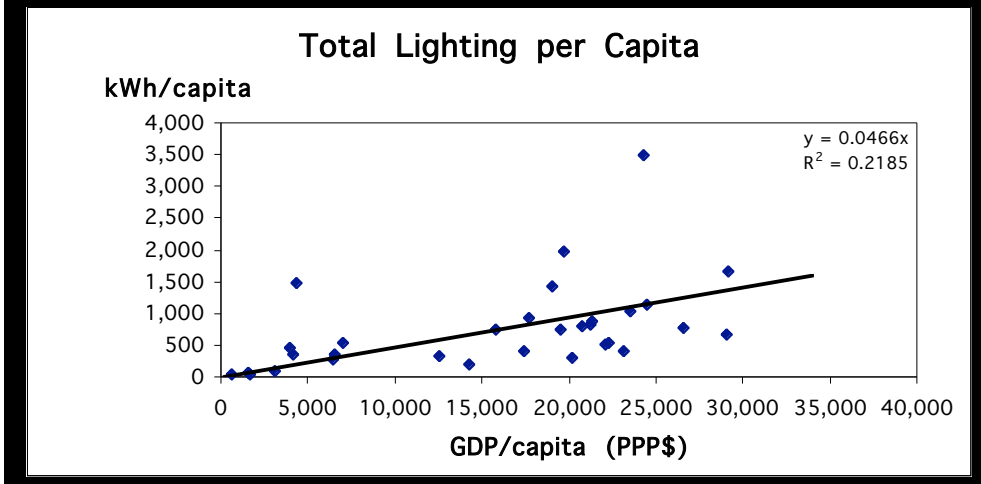
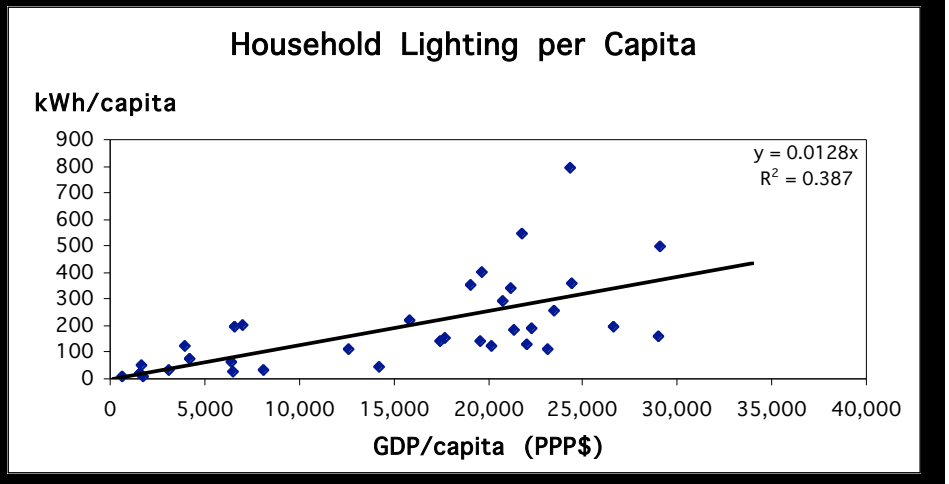
The $230B Global Lighting Energy Bill

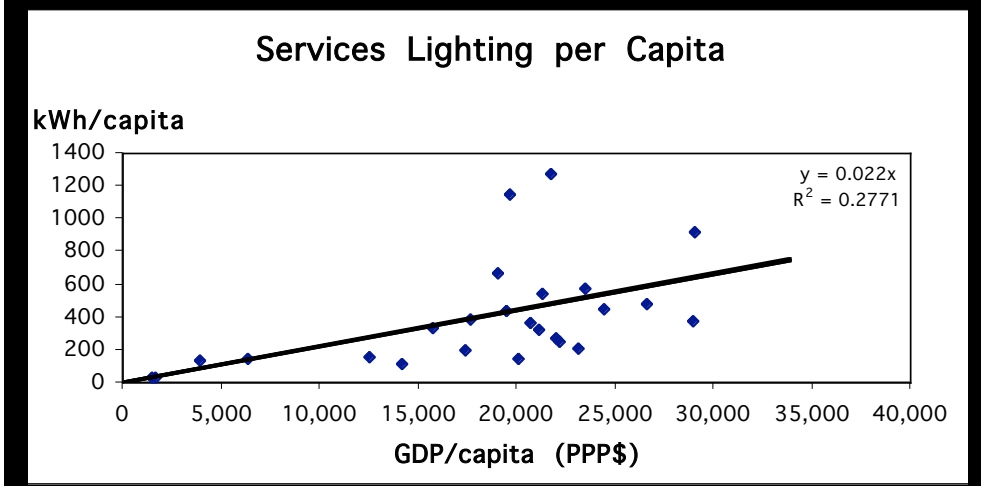


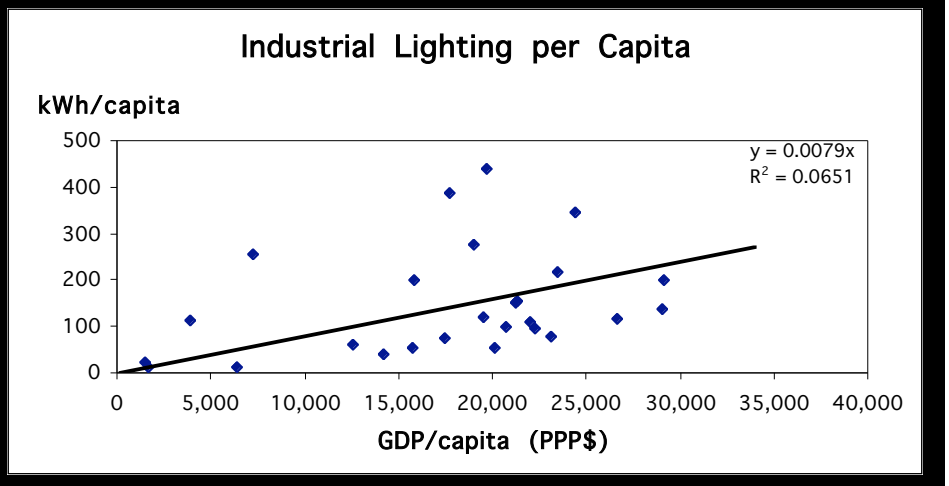
Evan Mills
Lawrence Berkeley National Laboratory

Data: Lighting Correlations
41 countries; 63% of world's population

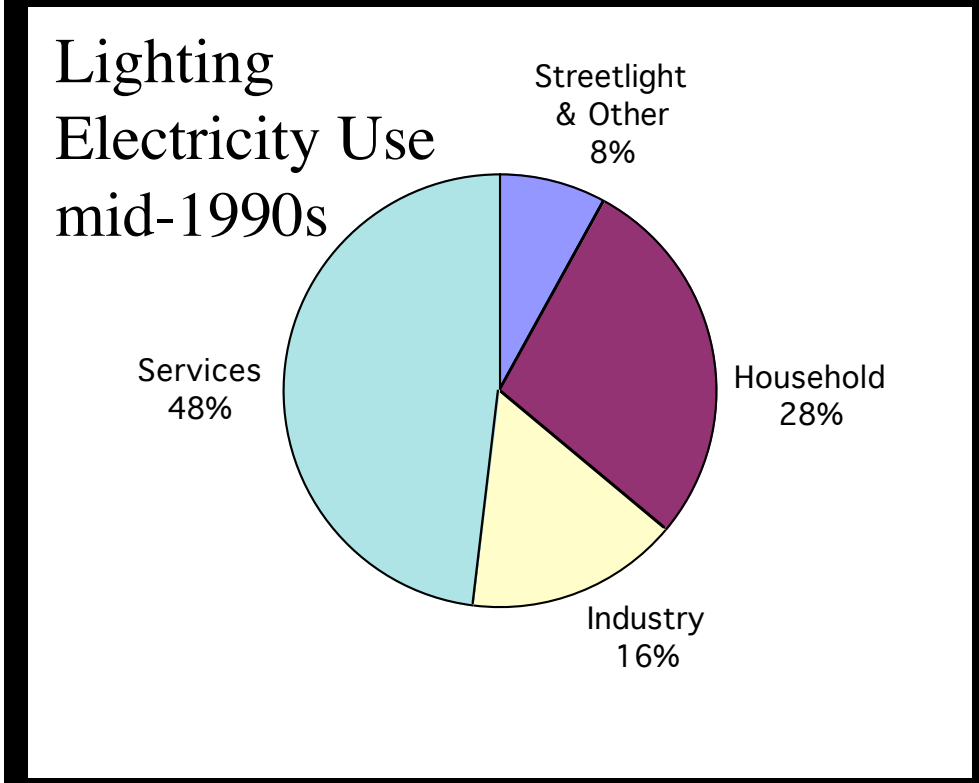








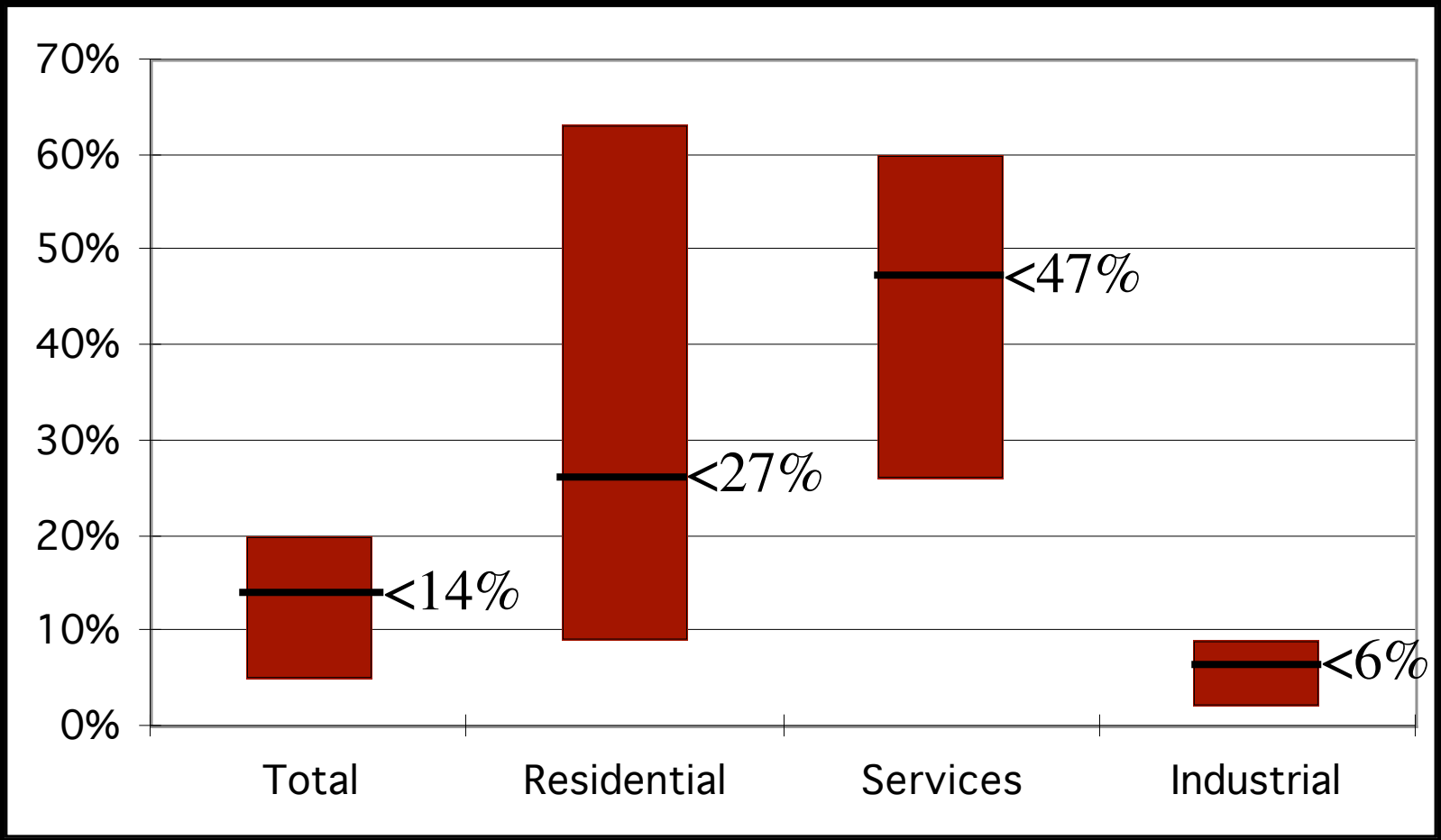
Global Lighting Electricity: 178 Countries



- Cost: $185 Billion/year
  (~50% in IEA countries)
- Power Plants: ~1000
  (400MW each)
- $C0_2$ Emissions: ~2Bt/year
- Kerosene: 1.7 Mboe/day
  (Brazil, Algeria, Libya, or Indonesia)
- Savings: $75-$115B/year
  (> Canada, France, or Germany TWh)

Conservatisms: most estimates go back to mid-1990s; excludes HVAC-interactions; T&D losses at 10%; electricity price $0.1/kWh; savings potential excludes daylighting

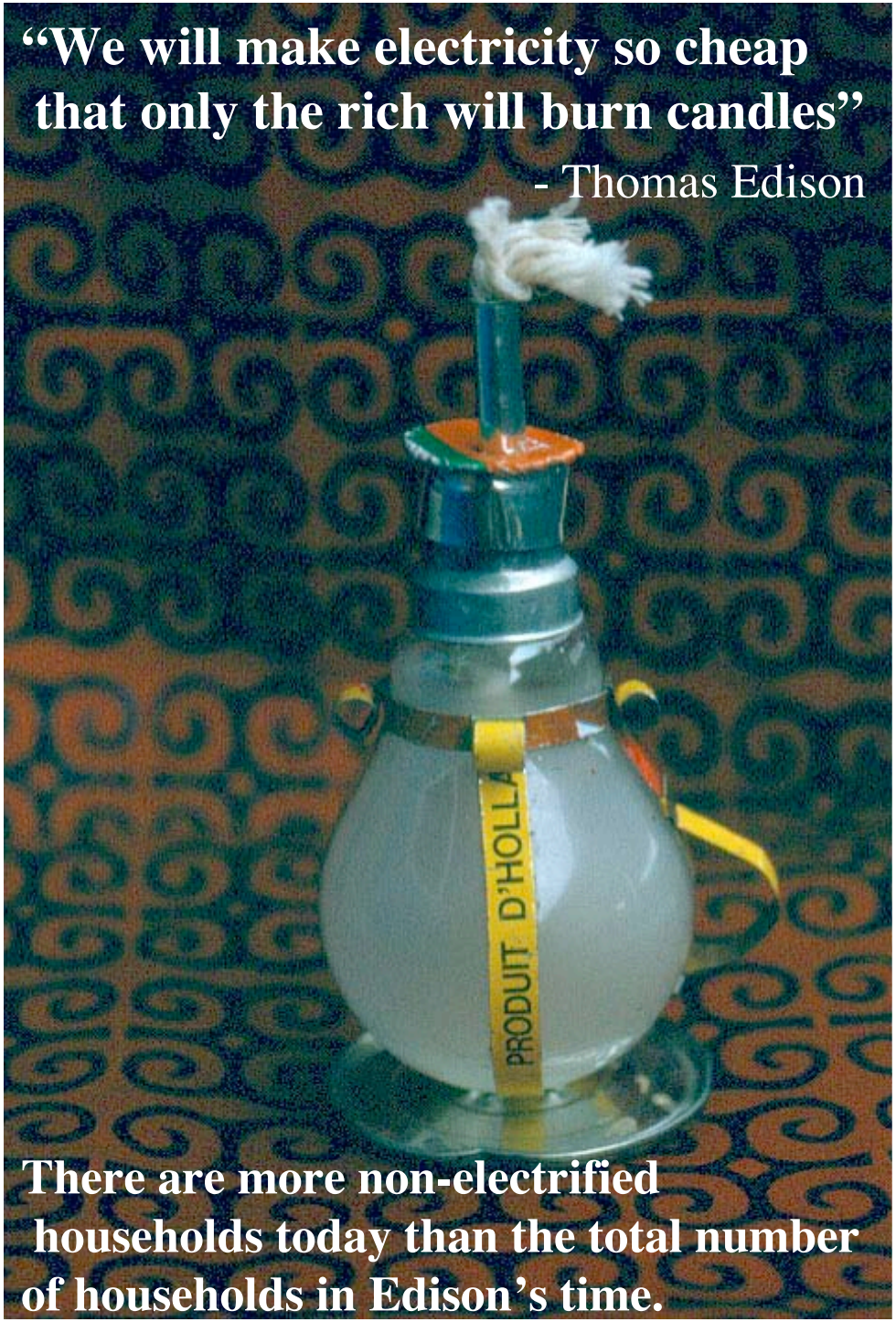
Range of Lighting's Share of Sectoral Total Electricity



2 Billion People (and rising) Use Fuel for Lighting

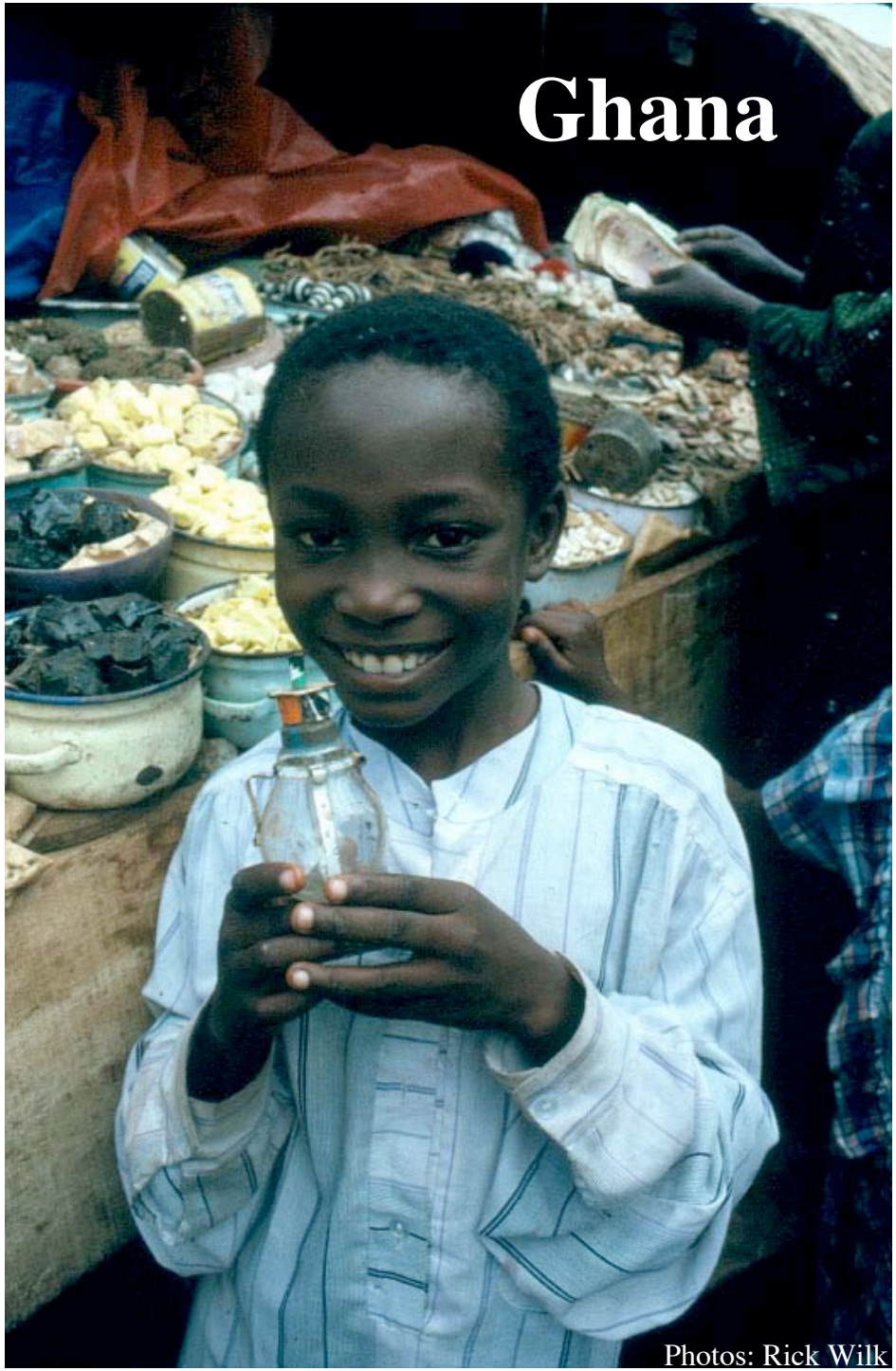
"We will make electricity so cheap that only the rich will burn candles"

- Thomas Edison



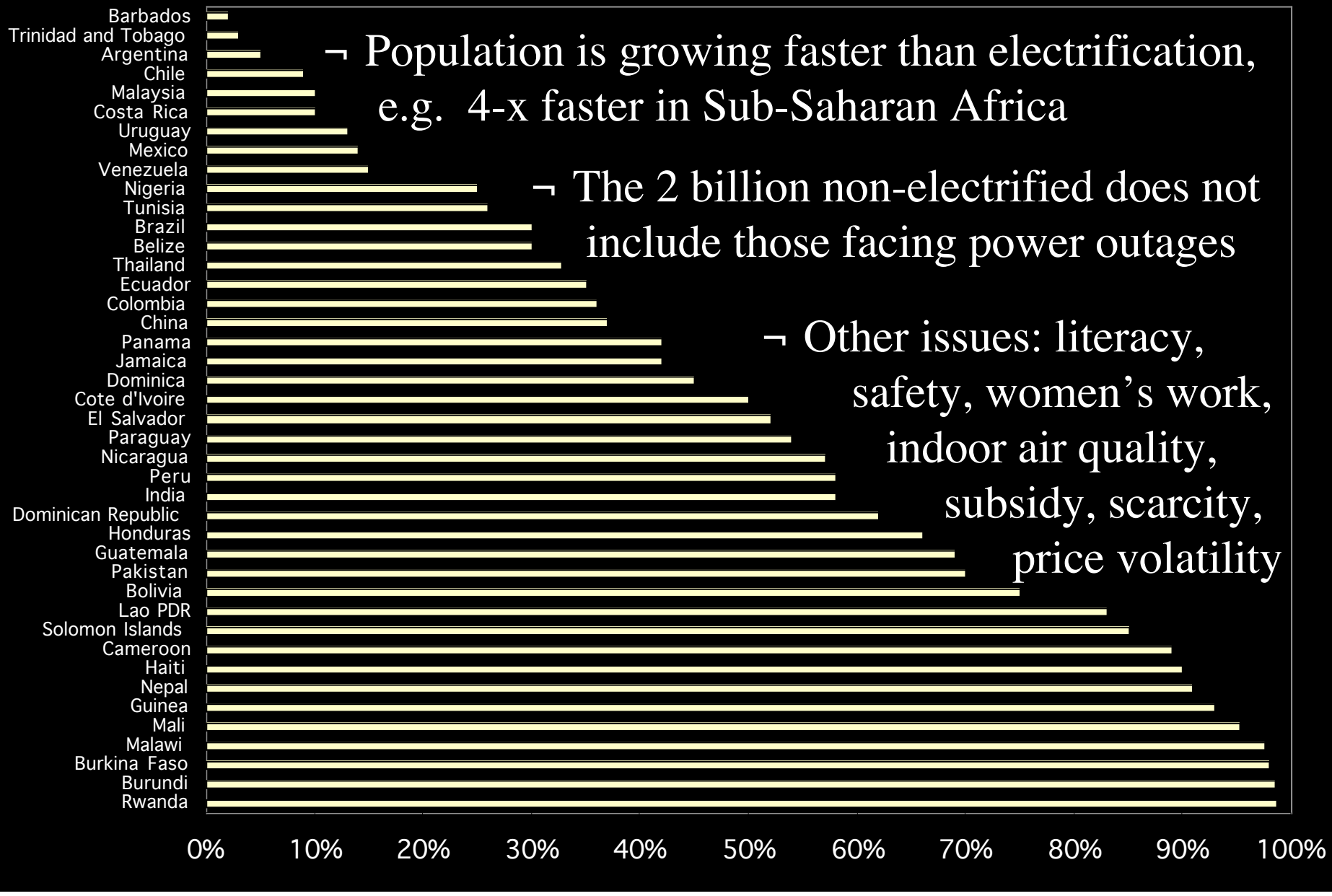
There are more non-electrified households today than the total number of households in Edison's time.

Ghana



Photos: Rick Wilk

Non-Electrified Population: mid-1990s

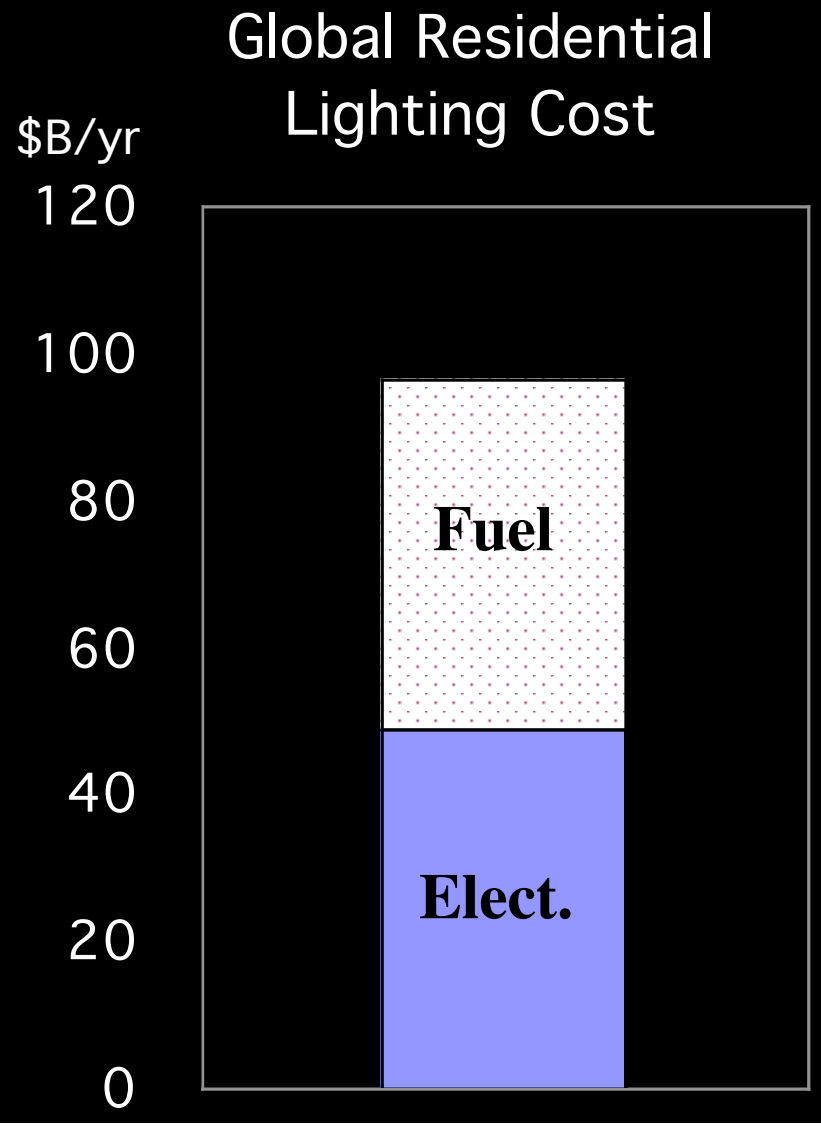


- Population is growing faster than electrification, e.g. 4-x faster in Sub-Saharan Africa
- The 2 billion non-electrified does not include those facing power outages
- Other issues: literacy, safety, women's work, indoor air quality, subsidy, scarcity, price volatility

An un-electrified household consumes as many lumens over an entire year as a 100W incandescent lamp produces in 10 hours

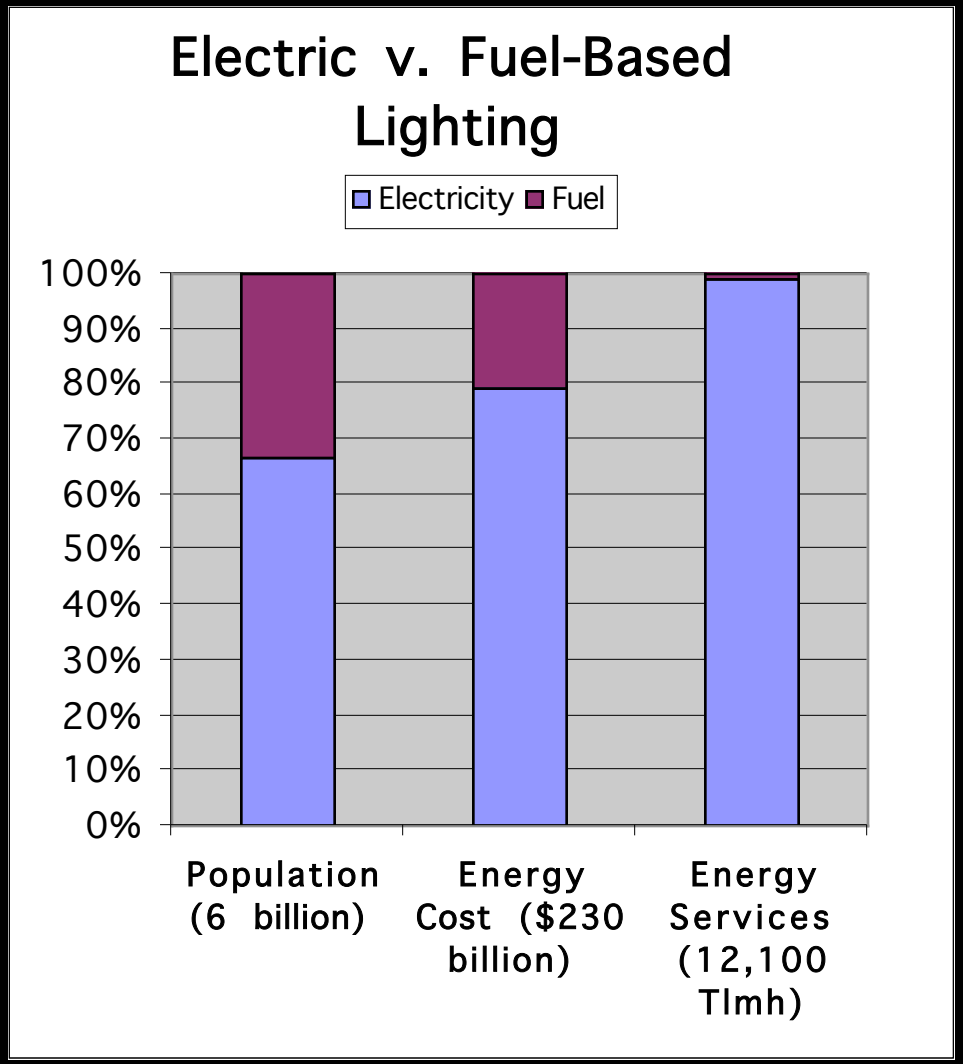
CFL v Flame

- Electric lamp provides 100-x more lumens
- Kerosene lamp consumes 1200-x more energy per lumen-hour
- Kerosene light costs 1600-x more per lumen hour

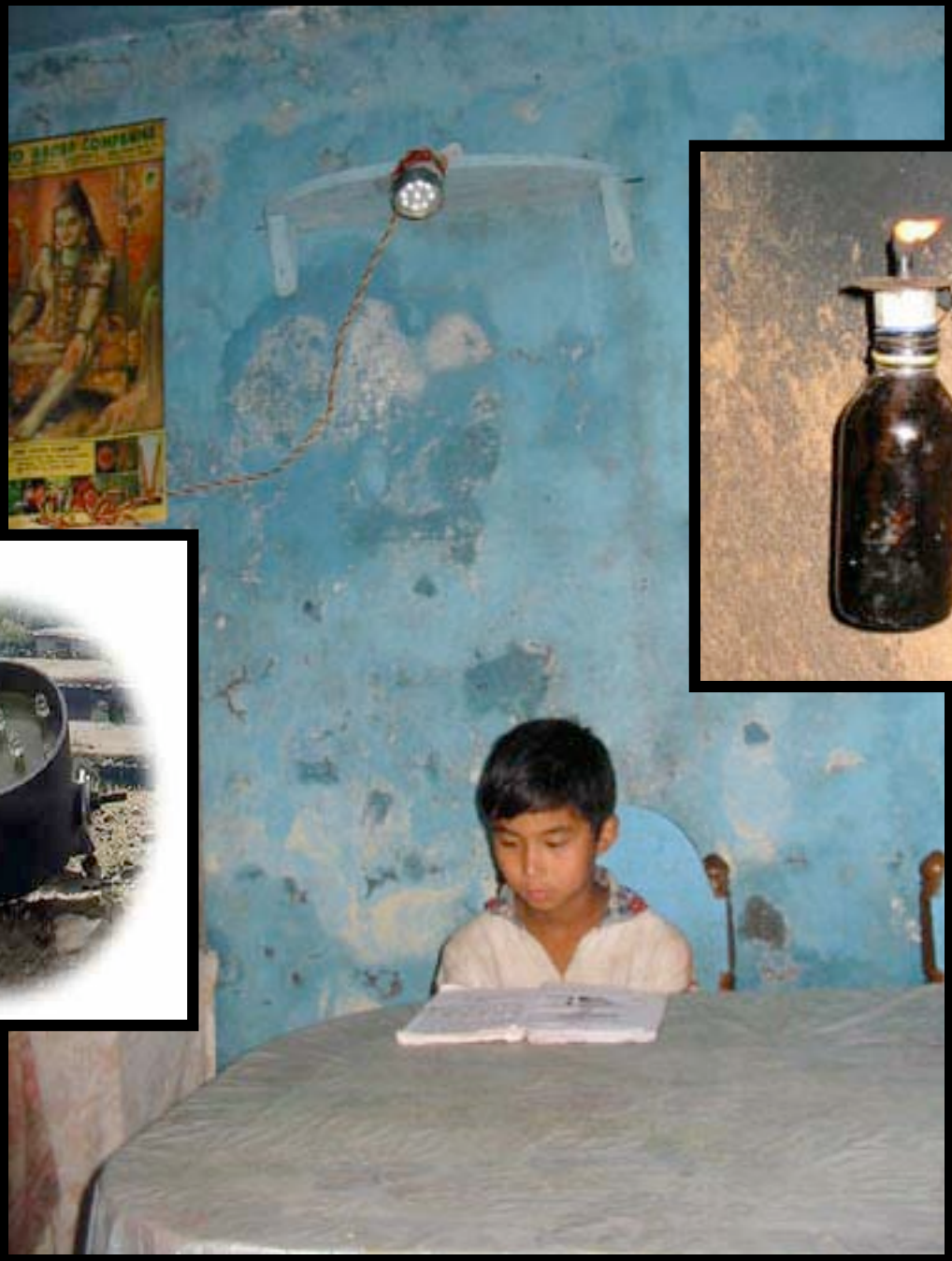


Lighting Equity

Although one in three people obtain light with kerosene and other fuels, representing about 20% of global lighting costs, they receive only 0.2% of the resulting lighting energy services.



India

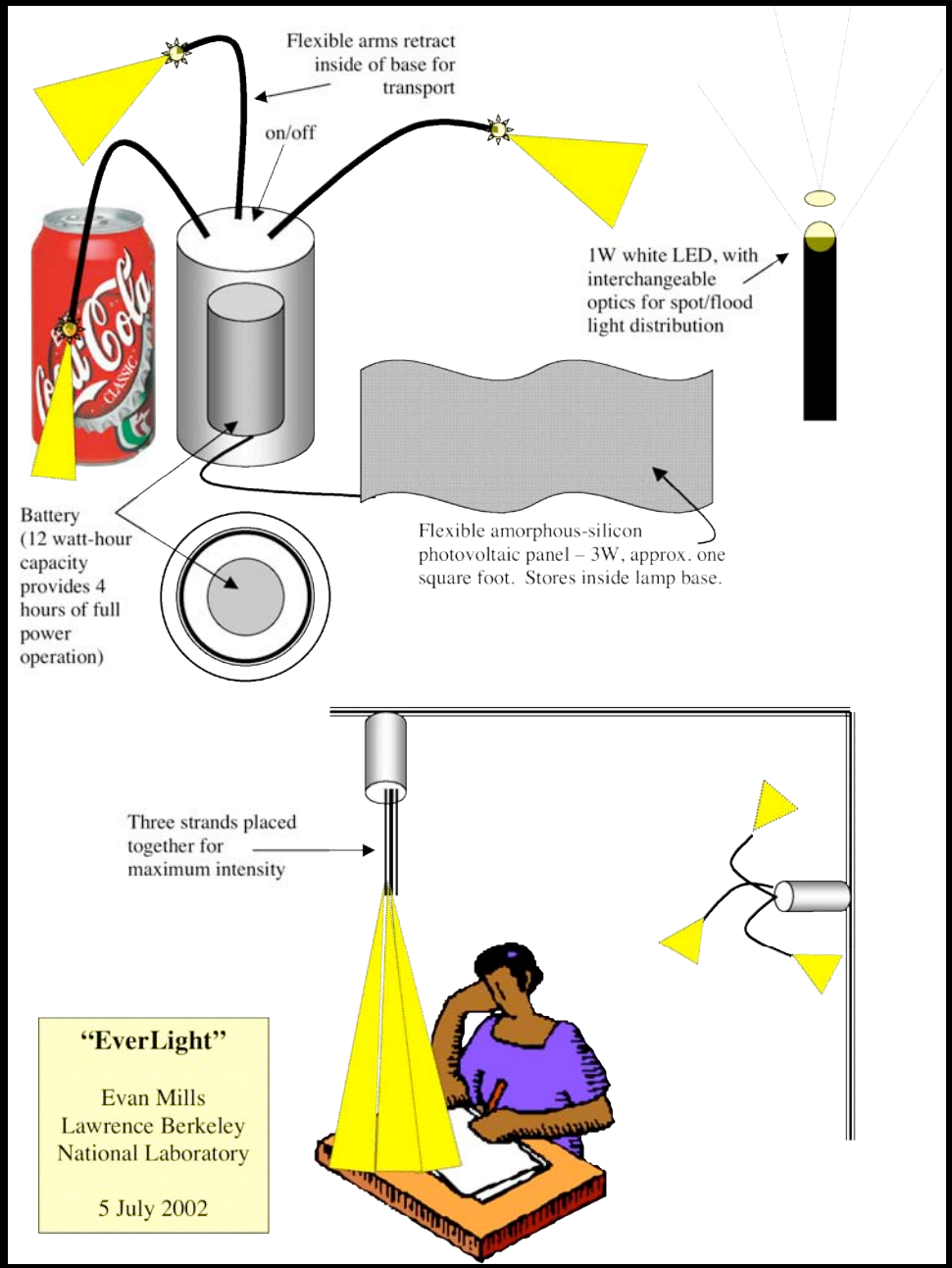


Nepal

Next Steps

- **Enhanced data compilation and quality**
- **Further analysis: prediction & potentials**
  - **Validation & refinement of models**
  - **Influence of electricity prices**
  - **Improved estimates of T&D losses**
  - **Non-residential kerosene use**
- **Re-engineering Rural Light Sources**

Everlight


Flexible arms retract inside of base for transport
on/off
1W white LED, with interchangeable optics for spot/flood light distribution
Battery (12 watt-hour capacity provides 4 hours of full power operation)
Flexible amorphous-silicon photovoltaic panel – 3W, approx. one square foot. Stores inside lamp base.
Three strands placed together for maximum intensity
"EverLight"
Evan Mills
Lawrence Berkeley National Laboratory
5 July 2002